

## Survey of proficiency and factors mitigating clinical skills acquisition during medical school training

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### Abstract

**Background:** Traditionally, the art and science of medical skills acquisition occur through an apprenticeship model where trainers supervise trainees who are learning on the patients exposed to variety of risk. The concern for patient safety and other limitations in provision of adequate training has necessitated the introduction of skills simulation for trainees to acquire certain proficiency before encounter with live patients.

**Objectives:** The study is aimed to determine the level of skills acquired and constraints experienced by newly graduated medical doctors during their training in various medical schools in Nigeria.

**Method:** Structured questionnaires were administered to interns undergoing orientation training programme at the University of Ilorin Teaching Hospital, Nigeria. Items were set to determine the frequency of practice and proficiency attained in basic clinical procedures during medical school training; and the factors that influenced their attempts of the procedures. The data was entered in SPSS for Windows version 17.0 and p value d" 0.05 was taken as statistically significant.

**Results:** There were 163 new interns who graduated from 11 medical schools (three outside Nigeria). The participants were aged between 22 and 35 years with no significant statistical difference between the mean ages of interns trained at home or abroad. Mean attempt of basic procedures ranged between 1.73 and 3.93 overall among 9.8 to 81.5% of the trainees. Most of them performed poorly on the pre-training self-assessed proficiency level. Urethral catheterization and intravenous cannulation were the commonest procedures done while the least performed procedures were nasogastric intubation, chest tube insertion; and fracture reduction and splinting (1.53-2.10 mean attempt) among less than 25% of trainees. Inadequate training facilities and competition between undergraduate and postgraduate trainees for procedures on the available but reluctant patients were considered as limiting factors in the acquisition of skills. However, inadequate number of trainers was considered least of a preventive factor.

**Conclusion:** Most medical graduates had inadequate exposures to skills acquisition from various medical training institutions due to inadequate volunteers (patients) and lack of students' call rooms for proximity to where and when the activity is taking place. We recommend that Clinical Skills acquisition through simulation should be integrated into the curricula of medical training institutions to facilitate acquisition of skills and ease practice on and safety of patients.

**Keywords:** Patient safety; medical errors, clinical skills, simulation; internship

### Résumé

**Contexte :** Traditionnellement, l'art et la science de l'acquisition des compétences médicales reposent sur un modèle d'apprentissage dans lequel les formateurs supervisent les stagiaires qui apprennent sur des patients exposés à une variété de risques. Le souci de la sécurité des patients et d'autres limitations dans la fourniture d'une formation adéquate ont nécessité l'introduction d'une simulation des compétences permettant aux stagiaires d'acquérir certaines compétences avant de rencontrer des patients vivants.

**Objectifs :** L'étude a pour objectif de déterminer le niveau de compétences acquises et les contraintes rencontrées par les médecins récemment diplômés au cours de leur formation dans diverses facultés de médecine au Nigéria.

**Méthode :** Des questionnaires structurés ont été administrés à des stagiaires prenant part à une formation de programme d'orientation à l'Hôpital d'Enseignement de l'Université d'Ilorin, au Nigeria. Des éléments ont été définis pour déterminer la fréquence de pratique et de maîtrise des procédures cliniques de base au cours de la formation en médecine ; et les facteurs qui ont influencé leurs tentatives des procédures. Les données ont été entrées dans SPSS pour Windows version 17.0 et la valeur p d" 0,05 a été considérée comme statistiquement significative.

**Résultats :** Il y'avait 163 nouveaux stagiaires qui ont été diplômés de 11 facultés de médecine (trois hors du Nigéria). Les participants étaient âgés de 22 à 35 ans et ne présentaient aucune différence statistique significative entre les âges moyens des stagiaires



formés au Nigeria ou à l'étranger. Le nombre moyen de tentatives de procédures de base variait globalement entre 1,73 et 3,93 chez 9,8 à 81,5% des stagiaires. La plupart d'entre eux ont eu de piètres résultats au niveau de compétence auto-évalué avant la formation. Le cathétérisme urétral et la canulation intraveineuse étaient les procédures les plus courantes, alors que les procédures les moins pratiquées étaient l'intubation nasogastrique, l'insertion d'un drain thoracique ; et réduction de la fracture et attelles (tentative moyenne de 1,53 à 2,10) parmi moins de 25% des stagiaires. Le manque de facilités de formation et la concurrence entre les stagiaires du premier cycle et des cycles supérieurs pour les interventions sur les patients disponibles mais réticents ont été considérés comme des facteurs limitants dans l'acquisition de compétences. Cependant, le nombre insuffisant de formateurs a été considéré comme moins d'un facteur préventif.

**Conclusion :** La plupart des diplômés en médecine ont été exposés de manière inadéquate à l'acquisition de compétences auprès de divers établissements de formation en médecine en raison du nombre insuffisant de volontaires (patients) et du manque de chambres d'appel pour les étudiants, à proximité du lieu et du moment de l'activité. Nous recommandons que l'acquisition de compétences cliniques par simulation soit intégrée aux programmes des établissements de formation médicale afin de faciliter l'acquisition de compétences et de faciliter la pratique sur et la sécurité des patients.

**Mots-clés :** *sécurité des patients ; erreurs médicales, compétences cliniques, simulation ; stage*

## Introduction

Historically, medical students and graduates learn clinical skills primarily by practice on live patients through an apprenticeship model. These patients are exposed to certain risks possibly regulated by seniors who supervise the juniors while learning on the job. Medical apprenticeship provides effective knowledge translation under supervision of experts [1,2]. The apprenticeship is championed by a mentor who is expected to possess not just superior skills and knowledge but also high moral and professional values [3].

In this model, the students start by observing clinical practitioners and are gradually given more tasks to perform as their competence grows, however, this is dependent on the day-to-day demands of the workplace where learning opportunities and supervision do not have first priority.[2,4] Hence, there are agitations for better methods to provide the optimal learning experience for students during their clerkships [2].

Skillful performance of practical skills, which could be lifesaving by junior doctors is fundamental to the delivery of quality service to patients [5]. Observed deficiencies in undergraduate programmes have been blamed on overpopulation in medical schools and lack of training facilities. Non-availability of volunteers (patients); and students' presumption of reliance on rote learning and chance have led to inadequacy in the skills [6]. These deficiencies often times result in junior doctors suboptimal performance of skills that they have not been prepared for [7,8]. This can be a significant source of stress for them[5] and a potential source of risk to their patients.

These patients are also becoming increasingly concerned and worried about potential harm that they are exposed to when medical trainees 'practise' on them. The emphasis on patients' safety and improved quality of care make the whole idea of bedside teaching and education to be gradually fizzling out [9-11].

The aim of this study was to determine the level of skills acquired and constraints experienced by newly graduated medical doctors during their training in various medical schools in Nigeria.

## Materials and method

Structured questionnaires were self-administered to newly employed interns at the University of Ilorin Teaching Hospital, Nigeria during the orientation training programme in the Clinical Skills and Simulation Laboratory of the College of Health Sciences. All interns who resumed together participated in the orientation training program and participated in the survey. The questionnaires were administered before commencement (as a pre-test) and after completion (post-test) of a 2-day clinical skills' training. Items in the questionnaires were meant to determine the frequency of practice of basic clinical procedures during medical school training and the proficiency attained; and to determine the factors that influenced their attempts of the procedures. The lead author (ALO) designed the scoring of proficiency as follows:

- None = 0 (No knowledge and skill of procedure)
- Low = 1 (vague theoretical knowledge and no exposure to skills of procedure)
- Moderate = 2 (Good theoretical knowledge and have performed procedure under supervision)
- High = 3 (Good theoretical knowledge and competency in procedure; can perform procedure without supervision).

The data was entered into SPSS for Windows version 17.0 and p value  $\leq 0.05$  was taken as statistically significant.



**Results**

One hundred and sixty new interns comprising of 65 in 2014, 57 in 2015 and 40 in 2016 participated in study. These were graduates from 8 Nigerian medical schools and 3 overseas medical schools.

They were aged between 22 and 35 years with insignificant statistical difference among the groups (Table 1). Of the minimum of 30 attempts (10 per year of clinical training of 3 years) of basic procedures mandatory for students, mean attempt

**Table 1:** Analysis of mean number of attempts at practice of procedures during medical school training

	2014 n= 66	% of parti- cipants with 3 attempts	2015 n= 57	% of parti- cipants with 3 attempts	2016 n=40	% of parti- cipants with 3 attempts	Sig. P-value
Age (years)	25.8 ±3.61		26.2±2.55		25.23±1.94		0.34
Sex (Male:Female)	48:18		2:1		2:1		0.72
Nasogastric_Intubation	1.95	23.6	2.18	33.4	1.83	19.4	0.33
Suturing_of_Wound	2.52	50	2.62	48.9	2.53	55.6	0.70
Cannulation	3.74	80.8	3.37	81.5	3.56	83.4	0.07
Blood_Transfusion	3.02	67.2	2.33	38.8	2.47	55.6	0.04*
Digital_Rectal	2.64	55.4	2.89	65.9	2.86	69.4	0.54
Cardiopulmonary	2.66	38	2.19	32	2.0	33.3	0.37
Urethral_Catheter	3.93	80	3.40	80	3.25	80.6	0.67
Chest_Tube_Insertion	1.73	9.8	1.53	13.2	1.08	11.1	0.03*
Lumbar_Puncture	2.26	38.3	2.43	45.9	1.75	36.1	0.27
Incision_and_Drainage	2.19	35.1	2.05	35.7	1.86	27.7	0.38
Scrubbing_and_Gowning	2.88	60.4	2.83	53.8	2.28	44.5	0.52
Aseptic_Gloving	2.92	62.7	3.09	68.2	2.92	68.5	0.58
Airway_Section	2.76	54.3	2.65	55.8	2.39	55.6	0.71
Airway_Access	2.08	25.6	1.90	20.5	1.58	22.2	0.26
Bone_Fracture	1.97	26.3	2.10	30.7	1.69	25.0	0.80

**Table 2:** Analysis of self-assessed proficiency of the three sets of interns

Year	2014		2015		2016		p-value
Variables	Mean score	% of parti- cipants with moderate score	Mean score	% of parti- cipants with moderate score	Mean score	% of parti- cipants with moderate score	
Nasogastric Tube	2.14	30.2	2.2	38.6	2.3	38.9	0.63
Suturing	2.0	25.0	2.1	28.1	2.18	36.1	0.64
Cannulation_and_Infusion	3.18	86.0	3.0	77.2	3.12	88.9	0.35
Blood Transfusion	2.8	65.6	2.35	41.8	2.3	50.0	0.01*
Digital_Rectal_Exam	2.9	37.8	2.6	54.5	2.7	69.5	0.83
Cardiopulmonary_							
Resuscitation	2.22	33.9	2.36	40.3	2.18	36.2	0.58
Urethral Catheter	3.15	81.6	2.95	68.5	2.9	77.8	0.31
Chest Tube Insertion	1.39	3.3	1.57	3.6	1.33	0	0.12
Lumbar Puncture	1.66	15.0	1.69	11.3	1.52	8.3	0.54
Incision And Drainage	1.97	31.2	2.0	24.5	1.94	22.3	0.95
Scrubbing	2.58	55.6	2.76	68.4	2.36	52.8	0.14
Aseptic Gloving	2.78	59.4	2.95	78.2	2.61	71.2	0.18
Recognition_of_Abnormal_							
Heart Sounds	2.29		2.55		2.55		0.06
Recognition_of_Abnormal_							
Breath Sounds	2.72		2.75		2.67		0.88
Recognition_of_Normal_							
Bowel Sounds	2.9		2.8		2.85		0.58



(actual) ranged between 1.73 and 3.93 overall among 9.8-81.5% of the trainees in all the groups in the 3 years, Table 1. Most of them performed poorly on the pre-orientation training self-assessed proficiency level, (Table 2). There is statistical difference among groups in the performance of blood transfusion (p value = 0.04) and chest tube insertion (p value = 0.03). The overseas trained interns confirmed that they learnt some of the procedures on mannequins as they never had contact with patients for legal reasons.

Urethral catheterization and intravenous cannulation were the commonest procedures done during medical school training in the three groups, though moderate to high proficiency level was up to 80%. The least performed procedures were nasogastric intubation, chest tube insertion; and fracture reduction and splinting (1.53-2.10 mean attempts) among less than 25% of trainees among whom were just 30% who had moderate pre-orientation training proficiency.

The factors that prevented adequate attempts and practice of procedures during training included

The participants suggested that greater supervision, provision of clinical skills simulation laboratory and provision of call rooms would have assisted them in observing and doing more procedures during training.

### Discussion

Medical internship which is also called housemanship is a compulsory phase in medical training in Nigeria and many countries in the world.[11] The duration is a year period in Nigeria but can be up to two years in other countries when a newly minted doctor is trained under a supervising consultant in an accredited medical facility.[12] During this period, interns participate fully in patients' management, which also includes performance of a number of procedures some of which are invasive.

In this study, the three sets of interns (2014, 2015 and 2016) graduated from eight medical schools in Nigeria, which gives a fair mix of experience and distribution of perception of medical training in the country.

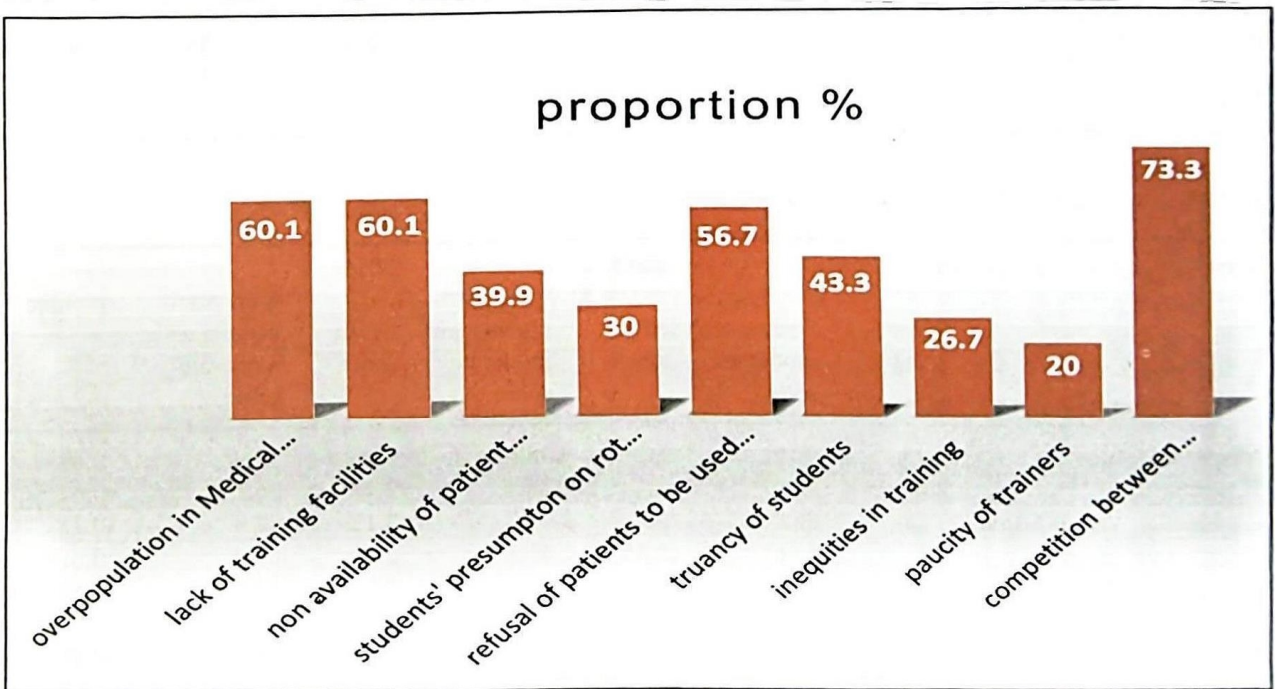


Fig. 1: The factors that influenced the attempts and proficiency of the participants

competition between undergraduate and postgraduate trainees for procedures on available patients (73.6%), overpopulation and lack of training facilities in medical schools (60% each), and refusal of patients to be "used as guinea pigs". Inadequate number of trainers was considered least as a preventive factor (Fig.1).

This study showed that many of the trainees had not attained at least 3 (10% percent) attempts on recommended basic procedures that should have been learnt before graduation. This goes to confirm that students do not see or perform enough basic procedures under supervision as expected during their training in the medical schools. The foreign



trained interns commented that they had restriction and exclusion from participation in patient care and procedures for legal reasons. This obviously will lead to several inadequacies in skills and can lead to major errors in patient care as alluded to in the previous studies.[6-9] The statistical difference among groups in the performance of blood transfusion and chest tube insertion confirmed restriction on some live saving procedures, which students should readily be conversant with the art and practice.

Some of the reasons given for inadequate skills acquisition were competition between undergraduate and postgraduate trainees for procedures on few available patients, overpopulation and lack of training facilities in their medical schools; and refusal by patients to be "used as guinea pigs" for trial of procedures. This is in consonance with other studies [6,7]. Most of the participants denied 'truancy' of students and inadequate trainers as causes of poor students' acquisition of skills in medical schools but reported that the distance of the hall of residence to the teaching hospital facilities prevented them from being present at the bedside when procedures were being done. They therefore, suggested that call rooms should also be provided for students so that they are available most times to participate in carrying out procedures. Ideally, medical students are expected to be offered accommodation on site appropriate to the placement they are doing with access to use of all amenities on site including internet access, well stocked library facilities and excellent catering and restaurant facilities [13,14].

Errors in medical practice are associated with great losses which might be apparent or concealed [15] Kaldjian *et al* [16]. reported that most faculty and resident physicians in US teaching hospitals were inclined to report harm-causing hypothetical errors, but only a minority have actually reported an error. More often than not these medical errors result in morbidities that hampers patients' capabilities and quality of life. These could be prevented by adequate training, drills and pre-procedure practice on mannequins, prefabricated and reconstructed models, animal experimental laboratory and virtual simulation laboratory [17].

Most participants in this study were exposed adequately to venipuncture and intravenous cannulation, urethral catheterization and sterile gloving during medical school training, however; the rated proficiency was low. This low proficiency might be blamed on inadequate practice and supervision, which could be mitigated by exposure

to training and practice on mannequins in the simulation laboratory as suggested by many of the participants. Evidence based projects like the Capstone project provides evidence that information in conjunction with simulation improve the competency of nurses in medication administration [18]. This training demonstrated that high proficiency in clinical skills and transfer of knowledge could be attained by using appropriate simulation tools in a safe environment. It has been proven that provision of learning resources, in the form of simulators and computer-based learning modules could successfully be adopted and integrated into medical schools' curriculum if well planned and adapted as may be necessary [17, 19-21]. Simulation-based medical education enables knowledge, skills and attitudes to be acquired for all healthcare professionals in a safe, educationally orientated and efficient manner [22].

Limitations of this study include our inability to objectively ascertain the impact of this short time training on the clinical practice on live patients in the hospital. However, we received commendation from the staff (nurses, doctors, etc.) on the wards describing the interns that had gone through the orientation training as 'new breed' who have made patients' care seamless through prompt and efficient performance of basic procedures as directed by their seniors. The other limitation is that we could not also compare the foreign trained students skills because their numbers were few (<5%/ group).

### Conclusion

Most medical graduates had inadequate exposure to skills acquisition from various medical training institution across the country. This was reflected in their low self-rated proficiency which they claimed was due to few available volunteering patients and lack of students call rooms for proximity to where and when the activities are taking place. Though, they claimed trainers were adequate, they requested for more supervision of performance of procedures. We recommend that simulation centres should be established and properly integrated into the curricula of training institutions in Nigeria to facilitate skills acquisition to optimal proficiency level in a safe environment. This is not a replacement for clinical exposure to live patients but will enable understanding of the details of the procedures and boost the confidence of the learners when approaching the live patients with ultimate elimination of errors.



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